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Storage Cabinetry for Art and Artifacts of Western New York
Genesee Country Museum
September 30, 2013

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Genesee Country Village and Museum (GCV&M) received funding from the National Endowment for the Humanities to convert two rooms in the John Wehle Art Gallery (AG) from exhibition galleries to a secure, energy-efficient, sustainable collections storage wing designed to house collections of fine arts, clothing and textiles, documentary artifacts, and 3-D objects. The project required a major renovation to these spaces, which is detailed below.

After the grant request was submitted, private and corporate funding became available to expand the project to include the entire AG facility. Thus the museum was able not only to renovate the storage wing, but also to upgrade conditions in the exhibit galleries to offer an appropriate environment for display. The information in this white paper focuses primarily on the creation of the storage spaces, but will also include pertinent information about environmental controls and lighting in the exhibition galleries.

Background Information

Genesee Country Village and Museum (GCV&M) maintains 68 historically significant structures relocated from thirteen surrounding counties to create a village setting at the museum. In addition, GCV&M operates an Art Gallery (AG) and a Nature Center located on its 700-acre campus. GCV&M serves residents of the cities of Rochester and Buffalo and the adjacent rural counties in western New York State.

The museum's holdings, which number over 30,000 objects, include a collection of portraiture, landscapes, genre, and still life representative of the popular art collected by people living in western NY in the 19th century, a superlative 19th century clothing collection, and important documentary artifacts and 3-D objects spanning the 18th and 19th centuries. In addition, GCV&M owns 950 paintings, drawings, prints, and sculptures within the sporting and wildlife art collections of its founder, John Wehle. Hailed by *Wildlife Art Magazine* as "the premier public collection of sporting art in America and one of the finest of the world," these works represent leading American and European artists, serving as a veritable who's who of the genres. The collections directly support GCV&M's mission to interpret and preserve objects that document 19th century life in western New York and America.

Before completion of this project, GCV&M had no storage spaces with humidity control. Most of the stored collections were inappropriately housed in unconditioned spaces in the upper stories of historic houses, the basement level of the museum retail shop and admission center, and in an uninsulated and unheated barn designated for curatorial use. Lack of acceptable storage

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bottlenecked museum operations, negatively impacting GCV&M's ability to care for existing collections, to acquire and refine collections, to make collections available for research, and to borrow artifacts for exhibition. Lack of appropriate storage also hindered implementation of the museum's interpretive plan, which calls for interpreting the second floor rooms of the Historic Village houses and making them accessible for the first time. The prime motivation for the project, however, was the fact that many objects were deteriorating due to the poor storage conditions.

This project was given utmost priority by the museum's board and administration because, quite simply, without good storage, the museum could not fulfill its mission to preserve its collections for future generations, nor could it function properly as an institution.

Goals and Preliminary Planning

Our challenge was to create a sustainable, energy-efficient storage area to economically and safely house and preserve the museum's most fragile and historically significant collections. We wished to achieve this goal in as "green" a way as possible, capitalizing on the most up-to-date passive energy techniques and simple equipment with low energy requirements to minimize both operation and maintenance costs.

We hoped to be able to renovate existing space to house collections in the AG rather than constructing new space, because the "greenest" building is one that is already standing. Responding to a general perception that the AG was poorly constructed, GCV&M commissioned Bero Architecture PLLC to determine if the building could be brought to meet current standards for collections exhibit and storage. Bero determined the building was structurally sound, but cost-saving measures taken during the original construction made a number of improvements necessary to provide a suitable interior environment.

In developing this environmental improvement and re-housing project, GCV&M Curator Patricia Tice and Senior Facilities Manager Edward Coons worked as a team with Bero Architecture (John Bero and John Page); a conservator familiar with our collections and experienced in planning storage facilities (Barbara Moore); and an experienced HVAC engineer committed to the investigation of sustainable solutions for museum storage (Lawrence Smith). This project team brought results of the most recent research by the Image Permanence Institute at the Rochester Institute of Technology, the Smithsonian Institution, the Canadian Conservation Institute, and others, into re-evaluating the functional definition of a good preserving

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environment. Based on this model, they developed a plan that employs the principles of sustainable use of energy and materials to create such an environment.

As part of pre-grant activities, the curator and conservator conducted a “storage needs” survey of the collections housed in curatorial barn and in houses in the Historic Village to determine the quantity and optimal type of storage equipment required (drawers, shelves, racks, etc.) to provide space-efficient and physically correct storage. In addition, the museum enacted a storm water management program to eliminate a long-standing problem of water penetration into the AG after heavy rains.

Detailed Description of the Project

Preparation of the Collection

Our initial plan was to securely pack artwork and textiles collections housed in the AG and to relocate them to areas within the facility that would not be affected by the renovation work in the storage wing. However, asbestos was unexpectedly discovered as part of a planned pre-construction hazardous materials survey. This situation necessitated the removal of the collections and staff from the building to a remote, secure, climate-controlled storage site.

Locating a suitable interim storage facility and carefully packing and moving this quantity of material offsite caused significant delays to our projected schedule. All objects were photographed to document their condition, and then were carefully wrapped and crated for the move.

We took advantage of the availability of the interim facility space to move household textiles from an unsuitable basement storage room located underneath the museum retail store. (For pest control purposes, we first froze and then vacuumed these textiles before integrating them with the other collections.) We also completed preparations for final storage installations.

Project Conservator Moore provided training sessions on handling methods, storage techniques, and construction of storage mounts for staff and volunteers involved with the move, and we completed many preparations for final storage during this interim period including:

- folding, padding and boxing fragile clothing in acid-free boxes
- rolling flat textiles onto acid-free tubes

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- creating supports with polyethylene batting and stockinet for objects such as shoes, reticules and other particularly fragile objects
- creating batting “rollers” to stuff and support fragile trimmings previously creased by being packed in boxes
- fabricating storage mounts for hats, purses, corsets and other accessories that facilitate safe handling.
- customizing padded coat hangers to better fit historic costumes sturdy enough for hanging storage
- sewing object id numbers into nearly 3000 historic costumes

Construction Phase

Contractors removed flooring, carpeting, and mechanical and electrical equipment and damaged exterior siding from the AG. In keeping with our goal to keep the project as “green” as possible, staff recycled damaged exterior siding into board fencing appropriate for use in the Historic Village.

Construction was extended by approximately eight to twelve months by the asbestos abatement program and by the greatly expanded scope of the project.

- While demolition was underway, tests were conducted to determine location and depth of wells to be drilled for a geothermal system. It was discovered that bedrock was at or near 150 feet of depth rather than the 200-foot depth for which the system was designed. Design modifications were made and drilling proceeded for forty-two 150 foot depth wells in an enlarged field. The geothermal design accommodates a closed loop system for harnessing the earth’s natural warming and cooling properties to provide a majority of the heating and cooling required for the entire AG, exclusive of the new storage rooms that rely on a passive system requiring far less energy.
- The existing concrete slab-on-grade floors in the two designated storage rooms were not built to support the weight of a mobile storage system and were not installed with a vapor retarder. Floors were removed, crushed, and used for granular fill on this project. This gave us the opportunity to provide perimeter foundation insulation and a sub-floor polyethylene vapor retarder beneath a new 12-inch thick reinforced concrete slab.

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- The new concrete slab was recessed to receive storage equipment rails. Epoxy concrete topping was added to level the floor with the storage equipment rails and provide a durable finish. The finished floor was sealed with Seal-Krete (VOC neutral), for ease of cleaning and to assist in the control of dust.
- Insulation was not provided beneath the floor permitting the mass of the earth to remain thermodynamically coupled to the space. The mass of the rooms has been increased to reduce peak temperatures. In this design, the earth beneath the building is utilized as a heat sink, assisting summer cooling and winter warming.
- Existing exterior walls consisted of concrete masonry units (CMU's), centered between interior and exterior furred wall cavities. Interior cavities had rigid insulation at most locations and were finished with a ¾ inch plaster system. Exterior cavities were empty and finished with wood board and batten siding in various states of deterioration. These walls were under-insulated (total wall R=10+/-), and lacked air barriers and vapor retarders. The CMU are fire resistant and provide mass, but the mass was poorly utilized because the wall was under-insulated. In order to improve wall insulation and include mass of the CMU within the conditioned envelope we insulated the existing exterior cavity with dense-packed cellulose blown in under high pressure (improving to a total wall R=22). This natural product is composed of 83% recycled material, with borates added to render it fire retardant, mold inhibiting, and insect repellent. Cellulose installed in this way acts as a vapor retarder.
- To accommodate the installation, we removed existing board and batten wood siding. Tyvek building wrap was installed between the exterior insulation and the salvaged board siding to provide an air barrier. This system permitted the existing interior furring, insulation, and plaster to be salvaged and reused without disturbance.
- We were able to significantly increase the mass of the CMU walls by filling the existing cores solid. While the exterior siding was off cores were accessed by removing the outer wythe of the upper CMU and pumping a grout slurry into the open cores. CMU soaps were then installed to close the access opening.
- The West Storage Room had an egress door and small wooden shed-like structure covering exterior concrete stairs and retaining walls. The shed and walls significantly deteriorated and the egress door posed security concerns and was therefore removed. The

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door opening was filled in to match the finished wall construction completing the well-insulated exterior mass wall system.

- The existing roof construction consisted of metal bar joists supported by steel ridge beams and perimeter CMU walls. Bar joists supported steel roof decking, OSB underlayment, and asphalt shingles. The existing ceiling was a standard 2 x 4 suspended acoustical tile with 3 inches of fiberglass insulation (R=11), loose-laid parallel with structural tees. Ceiling suspension wires and recessed lights created gaps in the insulation. Insulated ductwork was located in unconditioned space above the ceiling. Ceiling insulation was less than adequate thickness and significant additional heat was lost to air infiltration through the poorly fitted tile and gaps in the insulation. Therefore, the existing suspended ceiling, fiberglass insulation, recessed lights, and ductwork were removed in the two storage rooms and support spaces, and salvaged for Gallery repairs and reuse in other modern buildings in the Village. A structural ceiling was installed consisting of light gage metal joists supporting 5/8 inch fire-rated gypsum drywall and 12 inches of dense-packed cellulose (R=40), creating a well vented attic sealed against infiltration from the rooms below. Dense-packed cellulose doubles as air barrier and vapor retarder. No penetrations through the ceiling system were made. Lights and ductwork were located below the ceiling. Attic access is through existing gable end wall vents.
- Fluorescent lighting was installed with acrylic (UV-filtering) covers. Zoning of the lights allows parts of the storage rooms to be illuminated without lighting the entire space.
- Although not part of the grant proposal, we took this opportunity to replace standard exhibit lighting with an LED system, exchanging traditional 120 watt lamps for 7 watt LED lights. Based on the advice of James Druzik (Getty Conservation Institute), we chose to use ALTED Aurora white-warm CRI: 80 AC/DC 12V lamps.
- Finally, a high-density mobile storage system was installed on the in-floor rail system to allow safe storage of as much of the museum's collections as possible in these physically and environmentally secure rooms. The system includes racks for hanging clothing, shelves for boxed textiles and three-dimensional objects, rolled storage for large flat textiles, mobile platforms for sculpture, and mobile painting racks. The amount of each type of equipment is based on a "storage needs" matrix developed from the survey conducted by the curator and conservator.

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Energy Savings

The AG has achieved very significant savings in electricity. Before this renovation work, electricity for the entire museum campus cost approximately \$100,000 annually. (See Appendix A) Despite some increase in the electric rate since the completion of the project, and even with the newly added cost of electrically-operated fans to circulate air in the geothermal system, the annual electricity cost for the campus has dropped to approximately \$58,000 (a 42% saving). This saving is attributable to the new LED lighting, the reduced summer heat load and the economy of geothermal cooling compared with traditional air conditioning. In addition, oil consumption for the AG facility has dropped from a cost of over \$28,000 annually for nearly 9,000 gallons of oil to \$0, as we now use no oil at all. Over a ten-year period, these changes will amount to nearly \$700,000 in savings based on current prices.

According to recent and current research into environmental standards for museum materials, a range of 30% to 60% relative humidity is considered safe for most materials, with somewhat closer control for selected materials or object types. We had therefore planned to relax traditional environmental goals somewhat, and allow seasonal variation in conditions to conserve energy. However, the two storage spaces can now be maintained at humidity levels traditionally considered appropriate. Our data logs (see Appendix B) indicate that the relative humidity and temperature of the storage rooms have remained fairly stable, drifting upwards or downwards according to the season. From February through April 2013, the RH ranged between a low of 42% and a high of 53%, with an average RH of 48%. Room temperatures ranged from 68-72 degrees.

As expected, we experienced a seasonal drift upwards during the warmer and more humid months of July and August when the relative humidity gradually reached levels between 50% and 60%, with room temperatures at 69-72 degrees, with an average RH of 55%. This was accomplished using minimal energy input, achieved by the combination of passive measures - improved insulation, enclosed and increased thermal mass, and vapor and infiltration retarders - and the energy economy of geothermal heating and cooling.

We maintained the temperature in the storage rooms at an average 68-72 degrees for human comfort while we installed the collections in the storage equipment. When active work in the spaces is completed, we will lower the temperature to 65°F to enhance preservation.

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Lessons Learned

No project on this scale is completed without concerns, and we have learned lessons from the process.

- The museum experienced changeover of critical stage, including the Project Construction Manager, during the course of the project. In addition, the curator, who had expected to be on site, was relocated with the collections to the interim storage location 22 miles away. This resulted in a breakdown of communication and close supervision at times. As a consequence, some aspects of the project were not carried out as originally detailed. For example, the low-VOC paint that had been specified was not used, and as a result we have had to install chemical filters to counteract emissions in the storage rooms. We anticipate this problem will dissipate over time.
- Additionally, there was a breakdown in communication between the general contractor, engineer, and the subcontractors for the HVAC system. As noted earlier, changeover in GCV&M's Project Construction Manager also resulted in a loss of institutional memory. Consequently, when malfunctions have occurred, it has been difficult to trace to the exact source.
- Another difficulty was the timely integration of the museum's IT system with the system that controls the new HVAC units. This also has been resolved at time of writing.
- We had hoped that the HVAC equipment employed would be a simple design. However, our geothermal system is more complex than expected. Currently we require use of vendor technicians to make needed adjustments, but we plan to train our own physical plant staff to service these units in future.
- The schedule originally envisioned for the grant project took winter weather into account. As the schedule slipped, we found that we were unable to move furniture from village houses because of snow cover. Although we planned to move furniture during the summer of 2013, we next found ourselves dealing with unusually rainy weather that hampered the move. We began moving furniture into the gallery in August and we will continue this task until complete as weather conditions allow.
- On the positive side, the experience of the architects, HVAC engineer, and conservator working on the project, and the additional expertise provided by specialists such as Jim

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Reilly (Image Permanence Institute at RIT) and Jim Druzak (Getty Conservation Institute), were invaluable in making this project a success.

Outcomes

This project has exceeded our expectations in terms of energy savings, efficient and appropriate use of space, efficiency of work effort, and fiscal savings, as well as representing a revolution in collections preservation and care at our institution.

The renovation has also been an educational experience for the staff of the museum and our volunteers. It has raised awareness of collections care and has produced a renewed campus-wide pride in our collections and enthusiasm for a professional level of collections care.

In addition, we have offered tours of the new spaces to the public, special interest groups and staff of other museums. We hosted, for example, the Board of the Livingston County Historical Society as they endeavor to improve their own storage. We have also toured collections staffs from University of Rochester's Memorial AG, the Rochester Museum and Science Center, and the Manning-Morrison House in Brockport, NY. Many other regional museums have requested tours in the near future.

As a consequence of completing this project we are able to provide intellectual and physical access to our collections and have served students, researchers and staff interpreters. We have also been able to become an active member of the Costume Society of America and look forward to hosting their regional annual meeting in September 2014. At this meeting, we will present a paper on this project. Another paper that has been submitted is based on research performed on our newly-accessible collections.

We now have the facility that will enable us to carry out our mission and strategic plan. We expect to be an active participant in the museum and regional community as a direct result of this project. In our project proposal, we stated that we expected this project to be transformational, and our expectations have been confirmed.

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Appendices

Appendix A	Report of Electrical Expenditures
Appendix B	Sample of HVAC Logs
Appendix C	NEH Acknowledgement on GCV&M Website
Appendix D	Project Images